

# Estimating the Poverty Impacts of Trade Liberalization

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## Abstract

As a new round of World Trade Organization negotiations is being launched with greater emphasis on developing country participation, a body of literature is emerging which quantifies how international trade affects the poor in developing countries. In this survey of the literature, Reimer summarizes and classifies 35 trade and poverty studies into four methodological categories: cross-country regression, partial-equilibrium and cost-of-living analysis, general-equilibrium simulation, and micro-macro synthesis.

These categories include a broad range of methodologies in current use. The continuum of approaches is bounded on one end by econometric analysis of household expenditure data, which is the traditional domain of poverty specialists, and sometimes labeled the “bottom-up” approach. On the other end of the continuum are computable general equilibrium models based on national accounts data, or what might be called the “top-down” approach.

Another feature of several recent trade and poverty studies—and one of the primary conclusions to emerge from the October 2000 “Conference on Poverty and the International Economy” sponsored by Globkom and the World Bank—is the recognition that factor markets are

perhaps the most important link between trade and poverty, since households tend to be much more specialized in income than they are in consumption. Meanwhile, survey data on the income sources of developing-country households has become increasingly available. As a result, this survey gives particular emphasis to the means by which studies address factor market links between trade and poverty.

The general conclusion of Reimer’s survey is that any analysis of trade and poverty needs to be informed by both the bottom-up and top-down perspectives. Indeed, recent “two-step” micro-macro studies sequentially link these two types of frameworks, such that general equilibrium mechanisms are incorporated along with detailed household survey information. Another methodology in a similar spirit and also increasingly used involves incorporating large numbers of surveyed households into a general-equilibrium simulation model. Although most of these studies have so far been limited to a single region, these approaches can be readily adapted for multi-region modeling so that trade and poverty comparisons can be made across countries within a consistent framework.

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This paper—a product of Trade, Development Research Group—is part of a larger effort in the group to understand the impact of trade reform on poverty. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Paulina Flewitt, room MC3-333, telephone 202-473-2724, fax 202-522-1159, email address [pflewitt@worldbank.org](mailto:pflewitt@worldbank.org). Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at [reimerj@purdue.edu](mailto:reimerj@purdue.edu). February 2002. (35 pages)

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# **Estimating the Poverty Impacts of Trade Liberalization**

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## Table of Contents

I.	Introduction.....	1
II.	The Factor Income Link .....	4
III.	Cross-Country Regression.....	7
IV.	Partial-Equilibrium/Cost-of-Living Analysis .....	8
V.	General-Equilibrium Simulation .....	12
VI.	Micro-Macro Synthesis .....	17
VII.	Summary and Conclusions .....	21
	References .....	23

## List of Tables

Table 1.	Cross-Country Regression.....	29
Table 2.	Partial-Equilibrium/Cost-of-Living Analysis .....	29
Table 3.	General-Equilibrium Simulation .....	31
Table 4.	Micro-Macro Synthesis .....	35



## **I. Introduction**

A wave of trade liberalization over the last decade has positioned many developing countries to increasingly participate in world markets. This new openness has been accompanied by concern that the poor will be adversely affected, and that the distribution of income in developing countries will deteriorate. Indeed, suggestions have been made to emphasize poverty reduction in the next round of World Trade Organization (WTO) negotiations, and even to label it the “development round”. Accordingly, the issue of trade and developing-country poverty has become the focus of much research in the last several years.

This paper is a survey of recent studies that analyze how trade policies and other types of external shocks affect the incidence of poverty in developing countries. The objective is to summarize the methodologies of the diverse strands of research that are currently being conducted. It is not yet possible to provide a comprehensive synthesis of findings, since many of the studies are very much in the draft stage.

Not surprisingly, a variety of methodologies have been proposed to analyze the trade/poverty issue, which suggests that the range of findings will be nearly as diverse. The most obvious methodological gulf is between researchers who have come at these issues from a tradition of measuring poverty using detailed household expenditure data, and those who are of a trade background and more accustomed to dealing with economywide data. One might refer to these as “bottom-up” and “top-down” approaches, respectively. The former emphasizes the heterogeneity of individuals and households as revealed through surveys, while the latter builds on the microeconomic assumption of a representative agent. Since most studies focus on a single country, it is difficult to distinguish the degree to which findings are driven by methodological assumptions as opposed to characteristics of the particular population in question.

In spite of the methodological diversity of the studies, there appears to be increasing recognition that any analysis of trade, trade policy, and poverty needs to come to grips with the issue of factor market

effects. This was one of the key conclusions of the October 2000 *Conference on Poverty and the International Economy*, organized by the Swedish Parliamentary Commission on Global Development and the World Bank<sup>1</sup>. This observation has also been made in recent empirical studies by Coxhead and Warr (1995), Harrison, Rutherford, and Tarr (2000), Hertel, Preckel, Cranfield, and Ivanic (2001), and Warr (2001), each discussed in more detail below. The importance of factor market effects arises because households tend to be much more specialized with regard to factor earnings (that is, income derived from productive factors such as labor, capital, and land) than they are with regard to consumption.

Accordingly, this paper emphasizes how current analyses address the factor income side of the trade/poverty issue. For papers that incorporate factor earnings effects, particular attention is given to the sources of the data, and how researchers link factor income to individual households or household types. The primary means of describing this is via Tables 1 through 4 at the end of the paper, which summarize the objective, use of earnings data, general methodological approach, and conclusions of each paper.

To keep the survey manageable, and to avoid undue repetition of what has already been covered in other surveys, a set of criteria for inclusion was adopted. First of all, papers from the extensive literature on trade and wages are excluded since they are typically concerned with labor market and income distribution issues in *developed* instead of developing countries. Moreover, a number of excellent overview papers on that topic already exist, including Wood (1995) and Slaughter (1999). Within the realm of trade/poverty studies, this survey places emphasis on analyses that involve some sort of “counterfactual” simulation or regression analysis, as opposed to those only documenting how poverty has evolved over time. Simulation is stressed because it facilitates understanding of the links between a specific shock and poverty, holding other factors constant (indeed, the vast majority of trade/poverty studies employ some form of simulation analysis). While all the studies in this survey focus on the poor in developing countries, they do not all involve a change in trade policy. For example, a few papers on technical change and economic growth were included because their frameworks are highly relevant to

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<sup>1</sup> A web site describing the conference is: <http://www1.worldbank.org/wbiep/trade/povertyconf.html>.



trade policy analysis. Additionally, this survey places emphasis on studies that have an empirical rather than theoretical focus, and have been carried out within the last 10 years or so. Indeed, most of the papers surveyed are not yet in published form.

In collecting studies to include in this survey, it quickly became apparent that there is no obvious or ideal means to categorize them, since they differ in a number of significant ways. Studies vary across many dimensions, such as whether the analysis is carried out for representative households or actual households (i.e. microsimulation), whether it is static or dynamic, single- or multi-region, partial- or general-equilibrium, and so forth.

Out of these possibilities, four broad categories of study were identified based upon the principal methodology employed. The first methodological classification is for studies that undertake *cross-country regression analysis*. These studies test for correlations among trade, growth, income, poverty, and inequality variables observed at the national level.

The second category encompasses a wide array of *partial-equilibrium* and/or *cost-of-living* approaches. These studies are typically based on household expenditure data, and generally emphasize commodity markets and their role in determining poverty impacts, or at least as a measure of poverty across time.

Studies in the third category all involve some form of *general equilibrium* model that accounts for commodity, terms of trade, and factor market effects. These studies are usually based on a disaggregated economywide Social Accounting Matrix.

The fourth and final category represents a relatively recent approach – general equilibrium simulation coupled with some form of post-simulation analysis based on household survey data. These studies may be thought of as *micro-macro synthesis*. While the term “micro-macro” has been used differently in other contexts, in this paper it is meant to refer to the sequential linking of a model based on micro-level data with a model based primarily on macro-level data.

## II. The Factor Income Link

Before describing each of the methodological approaches in turn<sup>2</sup>, it is useful to consider the linkages that exist between trade, trade policy, and poverty. In a comprehensive paper on this topic, L. Alan Winters (2000) identifies several key linkages, which are reiterated in large part by Bannister and Thugge (2001). Potential links include changes in:

- (a) the price and availability of goods;
- (b) factor prices, income, and employment;
- (c) government transfers influenced by changes in revenue from trade taxes;
- (d) the incentives for investment and innovation, which affect long-run economic growth;
- (e) external shocks, in particular, changes in the terms of trade;
- (f) short-run risk and adjustment costs.

Most studies focus on only one or two of these linkages, while abstracting from the rest. Nearly all of the studies in this survey consider the consumption side of the trade-poverty linkage (a). Linkages (b) through (f) tend to be less frequently considered. A study by Levin (2000) focuses on transfers, link (c). A number of economy-wide analyses account for terms of trade effects, link (e). Each study typically abstracts from at least two of the linkages in order to keep the model tractable, and because the necessary data may not have been available. When reading a paper one should keep in mind which linkages are excluded from the analysis, and how this may influence the results.

As suggested in the introduction, the factor price, income, and employment link (b) may have the greatest relative importance of all the links between trade and poverty. Household survey data used in the Hertel, Preckel, Cranfield, and Ivanic study (described in section VI) as well as casual observation suggests that people tend to be much more heterogeneous with respect to income than with respect to consumption. In other words, two households may have identical commodity budget shares, and the same level of income, but entirely different *sources* of income; e.g., one derives all income from

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<sup>2</sup> Papers included in the survey are categorized and summarized at the end in Tables 1 through 4.

agricultural labor, while the other relies on transfers from a relative who works abroad. This point is underscored by the fact that opposition to free trade initiatives often arises from groups with highly specialized income, such as steel workers and sugar farmers in the U.S., to name just two examples.

Within the world of classical trade theory, income effects are key to the famous Stolper-Samuelson theorem, which relates international trade to the domestic distribution of income (Dixit and Norman). By the Heckscher-Ohlin theorem, a country has a comparative advantage in the good that intensively uses the country's relatively abundant factor. Free trade will increase the relative price of that good and so, by the Stolper-Samuelson theorem, increase the real return of the relatively abundant factor by an even *larger* percentage. At the same time, trade will reduce the return to the relatively scarce factor, though to a smaller degree. As a result, it can be said that changes in commodity prices due to trade liberalization *magnify* the resulting changes in factor prices.

The presence of this Magnification Effect (due to Jones, 1965) in theoretical trade models is one reason why trade economists tend to focus on factor market effects when analyzing trade liberalization and poverty. Some (e.g. Winters, 2000) have argued that the practical relevance of the Stolper-Samuleson/Magnification result is negligible, since it rests on so many restrictive assumptions as to be a special case. Nevertheless, this theoretical insight underscores the importance of considering factor earnings effects when examining the relationship between trade liberalization and poverty.

Three empirical studies reinforce this view. A general equilibrium analysis of technical change in the Philippines by Coxhead and Warr (1995) found earnings effects to be substantially more important than consumption effects. In particular, income effects accounted for two-thirds of poverty alleviation when there was a rise in agricultural productivity. While this is not a trade liberalization study, the nature of the shock is not dissimilar since the adjustments are transmitted through commodity and factor markets. Harrison, Rutherford, and Tarr (2000) find that factor price changes drive the incidence of trade liberalization in Turkey. They demonstrate this by employing three counterfactuals in which the 40 representative households in the analysis (differentiated by rural/urban orientation and by income level)

have (i) identical consumption shares, (ii) identical factor income shares, and then (iii) identical consumption *and* factor income shares. Since counterfactual (i) provided nearly identical results to those generated when the heterogeneity of the 40 households is left intact, the authors conclude that “clearly, for the poor it is the source of income, not the pattern of expenditure that is driving the adverse impact relative to the average household” (p. 12).

A general equilibrium analysis by Warr (2001) of Thailand’s proposed rice export tax also suggests that factor earnings effects are the driving force behind welfare and distributional effects. Although an export tax generates government revenue and lowers the price of rice for consumers, it also lowers the return to unskilled labor, which is used intensively in the Thai rice industry. Because both the rural and urban poor derive more than 40 percent of their income from unskilled labor (according to the Thai survey upon which the stylized households are based), the negative income effect ends up *outweighing* the consumption benefit, such that both the rural *and* urban poor are harmed by the export tax.

Despite the apparent importance of factor earnings effects, they are often not accounted for in studies that quantify the effects of external shocks on the poor in developing countries. This is particularly the case for analyses based on detailed household surveys, at least historically. Because abstracting from this particular linkage may be quite misleading, this survey will pay particular attention to how each analysis deals with the income side of the story. At the same time, the issue of whether a focus on “factor markets” is the same as a focus on “income” is not explored in depth here. It can be argued that many of the poor are subsistence farmers and largely disconnected from markets, or that their well being is largely determined by their net trade position in a food commodity such as rice. Studies that explore this latter issue in more detail include Ravallion (1990) and Ravallion and van de Walle (1991). As to the importance of thinking about a household’s income in terms of commodities versus factors, Hertel, Preckel, Cranfield, and Ivanic (2001) provide interesting survey evidence on this issue for seven developing countries in Figures 1-21 of their paper.

### **III. Cross-Country Regression**

As discussed above, four general methodologies are in current use for estimating the poverty impacts of trade liberalization. The first approach considered in this survey is cross-country regression, as exemplified in a recent paper by Dollar and Kraay (2001). These authors first categorize developing countries as either globalizers or non-globalizers based on changes in trade volumes and tariff rates since 1980, then carry out case study as well as statistical analysis. Looking at anecdotal evidence on poverty, including time-series Gini coefficients and income growth rates for average households versus the poorest quintile, they find no general trend in inequality among countries classified as globalizers. Globalizers, however, tend to have higher rates of growth than non-globalizers. This leads to the conclusion that globalization tends to be associated with a decline in absolute poverty. Verifying these findings in a more rigorous manner, the authors undertook cross-country regression analysis, and determined that no systematic relationship exists between changes in trade volumes and changes in the income share of the poorest. Additionally, no statistical relationship between changes in trade volumes and changes in income inequality could be found.

Rodrik (2000) offers a cogent critique of Dollar and Kraay's study. In general his remarks relate to issues with the data, to the difficulty of distinguishing between correlation and causation in cross-country regression analysis, and to the challenge of obtaining results that are robust to specification changes. Estimating the relationships that exist between trade policy, growth, and poverty depends critically on finding appropriate measures of these variables, and carefully sorting out omitted variable and endogeneity problems, all of which are quite challenging given the very limited data available. The fact that Dollar and Kraay include results obtained using Instrumental Variables provides some reassurance against Rodrik's critique.

Most trade and poverty researchers forego cross-country regression analysis and instead carry out some form of simulation analysis (this can be verified by comparing the very limited number of papers in

Table 1 with the much larger number of papers in Tables 2 - 4). The hallmark of simulation analysis is the use of a *counterfactual*, which literally means “contrary to the facts” and enables investigation of “what might have been” had a certain shock taken place. The great advantage of counterfactuals is that the effects of a specific shock can be isolated from the effects of all other events occurring during the period of interest. Counterfactual analysis, therefore, provides an elegant means of avoiding the identification problems inherent to cross-country regression, while allowing the researcher to pose specific policy questions once the appropriate simulation model has been operationalized.

The cross-country regression approach nevertheless has a number of advantages for understanding the links between trade and poverty. First of all, it enables the use of traditional statistical tools for *testing* results and hypotheses, as opposed to only making predictions<sup>3</sup>. Secondly, cross-country regression results are typically much more general than the country-specific results of many applied simulation models. Thirdly, cross-country regression may be able to account for some of the dynamic aspects of trade reform that are missed by static simulation models. Given the differing advantages and disadvantages associated with the cross-country regression and simulation approaches, they should probably be viewed as complementary forms of analysis as opposed to substitutes.

#### **IV. Partial-Equilibrium/Cost-of-Living Analysis**

The second general methodology identified as a means of estimating the poverty impacts of trade liberalization is partial-equilibrium/cost-of-living analysis. The awkwardness of this characterization reflects the fact that more than one type of study is included in this category. In general, however, all of the studies in this category are “partial equilibrium” in nature, since they focus on one or a limited number of markets in an economy. Additionally, most can be considered “cost-of-living” studies since they tend to focus on household expenditure as a measure of poverty.

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<sup>3</sup> At the same time, techniques such as Systematic Sensitivity Analysis are available and increasingly used for assessing the robustness of results from calibrated simulation models.

The majority of studies in this category can also be regarded as microsimulation models. Microsimulation is distinguished by a focus on behavior at the individual or household level, as opposed to using any sort of *representative* household. As such, individual or household survey data are key to applications of the microsimulation approach. It should be noted that microsimulation is sometimes associated with general equilibrium contexts as well (see, for example, the studies by Cogneau and Robilliard, and Cockburn).

A great many papers fit into the partial-equilibrium/cost-of-living analysis category (see Table 2 for the complete list). One fairly representative approach is by Levinsohn, Berry, and Friedman (1999), who examine how the Indonesian economic crisis affected poor households in that country. The authors combined 1993 consumption data for 58,100 households from the Susenas survey, along with price changes due to the 1997-1998 crisis, to compute household-specific cost-of-living changes. The salient findings were that very low income households were not insulated from the international shocks, and in fact tended to be hurt the most. Regardless of being urban or rural, households at lower expenditure levels experienced larger cost-of-living increases (a relationship that is monotonic). Additionally, the consumer price impacts of the crisis were greater for urban than for rural areas, and greatest overall for the urban poor.

From a methodological perspective, the Levinsohn, Berry, and Friedman analysis has two principal drawbacks. First, focusing only on the consumption side of the crisis (link (a) in section II) precluded calculation of its *real* effects. This may not have been so critical for this particular application, since increases in nominal wages were overshadowed by increases in general commodity prices (an average of 26.0% versus 92.5% according to Levinsohn, Berry, and Friedman). However, studies focusing on trade liberalization generally find factor market effects to be at least as important as commodity market effects. Secondly, the Levinsohn, Berry, and Friedman analysis did not allow the effects of the crisis to be isolated from other phenomena, including the El Nino drought and widespread

forest fires that occurred in the same period as the crisis. This drawback could have been avoided in a model enabling the specification of counterfactual simulations<sup>4</sup>.

Another methodological limitation of significance to this survey was that household expenditure shares in the Levinsohn, Berry, and Friedman study were assumed to stay fixed throughout the crisis. Changes in demand due to changes in income or the prices of other goods were ignored. In terms of a household's demand schedule for a given good, movements along as well as shifts in the demand curve were precluded. Estimation of a demand system, particularly one that is non-homothetic, would have avoided this issue. Another limitation is that the expenditure shares were outdated, since Indonesia in 1997 had changed substantially from where it had been in 1993. The authors point out, however, that the consumption baskets of poor households *relative* to rich ones, and rural households *relative* to urban ones, likely did not vary much over this period. This is relevant because the authors were primarily interested in assessing the relative impact of the crisis across income levels, and between rural and urban areas.

Another approach to trade, price changes, and poverty is provided by Case (1998). She quantifies the extent that trade reform in South Africa will affect households as consumers, using household budget shares and estimates from a Linear Expenditure System estimated separately for Africans and Whites. Budget shares and the demand system estimates were calculated using the nationally representative 1993 South African Living Standards Survey, which covers 43,794 individuals in 8,848 households drawn from 360 clusters. Using outside estimates of the price changes following tariff reform, it is found that the cost of reaching the household's initial level of utility falls by roughly 2 percent for African households and by 1 percent for White households. As with the Levinsohn, Berry, and Friedman study, potential factor earnings effects do not enter into Case's analysis, despite the availability of employment and income information in the household survey.

A third example of how partial equilibrium models are being used to address trade and poverty issues is Minot and Goletti (2000), who offer an extensive examination of how rice market liberalization

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<sup>4</sup> See, for example, Robilliard, Bourguignon, and Robinson (2001) for an alternative assessment of the Indonesian



in Viet Nam may affect income and poverty in that country. They employ a variety of methods to reach their research objective, including descriptive analysis based on surveys of rice producers, traders, and other market participants; time-series analysis of rice prices and production; and estimation of household demand behavior based on the nationally representative 1992-93 Viet Nam Living Standards Survey of 4,800 households. Households in poverty are defined as those below the 25<sup>th</sup> percentile in terms of per capita expenditure, and results are provided in terms of the Foster-Greer-Thorbecke poverty index as well.

The centerpiece of Minot and Goletti's analysis is a multimarket spatial equilibrium model that is used to conduct a series of policy experiments, including (i) removing the rice export quota, (ii) changing the quota level, (iii) replacing the quota with a tax, and (iv) removing restrictions on the internal movement of food. The distributional consequences of these counterfactuals are determined by way of the net rice sales position of different household classes. It is found that export liberalization raises rice prices within the country, particularly in the country's rice exporting areas. The higher prices have a positive effect on rural incomes, and are generally favorable with regard to the number of people in poverty. Relaxing the restrictions on the internal movement of rice from south to north generates net benefits for the country, without increasing most measures of poverty.

Since rice production is quite labor intensive in Viet Nam, a rise in rice prices should increase demand for agricultural labor, and consequently the agricultural wage rate. Higher rice prices would then lead to a greater decrease in poverty, particularly in households that derive a share of their income from agricultural labor. Unfortunately, Minot and Goletti's counterfactual analysis assumes that labor demand and wage rates remain constant. While they point out that landlessness and the use of hired labor are not widespread in Viet Nam, inclusion of a factor earnings link (b) would have quantified this perception.

## V. General-Equilibrium Simulation

If a researcher is interested in how trade liberalization will affect only a limited number of an economy's markets, needs to incorporate a great amount of sectoral detail, or has limited time available, then partial-equilibrium/cost-of-living analyses are logical approaches. They also have the advantage of being easier to understand than general equilibrium modeling. When examining the question of poverty, however, partial-equilibrium/cost-of-living analysis usually requires a researcher to abstract from the income side of the issue, or limit the analysis to consideration of a single factor (typically labor). The focus on commodity markets is due in part to a traditional lack of good data on household earnings, since in household surveys income information tends to be less complete and less reliable than expenditure information (Cockburn; Hertel *et al.*). However, several recent empirical studies provide evidence that – regardless of the data limitations – this abstraction is not innocuous<sup>5</sup>.

General equilibrium analysis of poverty and distribution issues in a developing country context has its origins in work by Adelman and Robinson for Korea (1978), along with Lysy and Taylor for Brazil (1980). General equilibrium models are now widely used to assess the impact of economic shocks that reverberate across sectors and, in some cases, regions of a country or even the world. They are capable of producing disaggregated results at the microeconomic level, while providing a consistency check on macroeconomic accounts. A general equilibrium model is generally calibrated to a Social Accounting Matrix, which is a complete, consistent, and disaggregated data system. The salient feature of Social Accounting Matrixes is that they quantify – at a single point in time – the interdependence of sectors and regions in an economy. General equilibrium models are typically based on neoclassical theories of firm and household behavior, and have a time frame long enough to achieve equilibrium in markets. While most are comparative static in nature, dynamic versions have also been developed to address certain types of issues.

A study by Löfgren (1999) is representative of how applied general equilibrium models are

currently being used to analyze trade and poverty issues. Löfgren investigates how reduced agricultural and industrial protection will affect representative Moroccan households in the short run. The general equilibrium model is multi-sector, single-region, static, and calibrated to a 1994 Social Accounting Matrix<sup>6</sup>, which captures the pronounced rural/urban disparity in economic structure, wages, and education that is characteristic of Morocco. Four household groups are distinguished according to whether they are rural or urban, poor or non-poor. Unlike two studies examined below in this section, the distribution of income within the groups is not modeled, as the study does not seek to make statements about the total income distribution.

Based on information in the Social Accounting Matrix, Löfgren divides factor markets into four types of agricultural resources, five types of capital, and a variety of labor types, differentiated by skill, urban/rural orientation, and use in agriculture. Production is specified as a Leontief function of aggregate value-added and an aggregate intermediate input, which are a constant elasticity of substitution (CES) function of primary factors, and a Leontief function of intermediate inputs, respectively. Consumer demand is represented by the Linear Expenditure System. The model relies on standard neoclassical assumptions and is set up in “real” terms, such that there are no asset markets, money is neutral, and all agents make decisions as a function of relative prices.

Löfgren’s simulations assess the impact of removing border protection under different assumptions about labor market rigidity. The essential results are that trade liberalization in agriculture will result in gains for the country as a whole, while the rural poor loses out. Compensation in the form of government transfers as well as education and infrastructure investments for rural areas would likely be needed if liberalization were to be pursued.

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<sup>5</sup> See Coxhead and Warr (1995), Harrison, Rutherford, and Tarr (2000), Warr (2001), and Hertel, Preckel, Cranfield, and Ivanic (2001).

<sup>6</sup> The Social Accounting Matrix – upon which the credibility of the results hinges – was developed using a numerous data sources, including statistical publications from the Moroccan government, the World Bank (including the RMSM data base), the Food and Agricultural Organization, the International Monetary Fund, various Royaume du Maroc statistical volumes (see Löfgren’s paper for details). The procedures for designing the stylized households from survey data are not discussed.

On the methodological side, Löfgren finds that the results are strongly influenced by the commodity, factor, foreign exchange, and government budget links between agriculture and the rest of the economy, which correspond to links (a), (b), (c), and (e) listed in section II of this survey. Of all the potential linkages identified by Winters (2000), Löfgren's analysis excludes only the investment and innovation link (d), and risk and adjustment cost link (f). Ignoring these two effects would likely result in systematic underestimation of the long-run *benefits* and short-run *costs* of trade liberalization, respectively. Determining the ultimate importance of these linkages would require specification of a dynamic model.

Löfgren's general approach is more or less representative of a large number of trade and poverty studies carried out over the past decade (see Table 3). One variant of this basic paradigm is to address in greater detail how external shocks affect the *total* income distribution of a country. For this purpose it is necessary to postulate a distribution of income for each representative household type (as in Adelman and Robinson, 1978) or to work at the level of actual households (as in Cogneau and Robilliard, and Cockburn). If a distribution is assumed *a priori*, it can then be used in conjunction with the general equilibrium model to assess the impact of exogenous shocks on the income distribution of a country, as well as poverty. In this framework, it is typically the case that the mean and total income levels for a household group are endogenous while the higher moments of the distribution are fixed.

In an interesting paper, Decaluwé, Patry, Savard, and Thorbecke (1999) consider this basic approach and provide some refinements to it. They model an archetype African economy with two agricultural activities, four non-agricultural activities, and six representative household groups. One of the innovations is the use of a flexible Beta functional form to model the income distribution within household groups, instead of the more common – and restrictive – lognormal or Pareto distributions. The parameters of the Beta distribution are specified to conform to observed socio-economic characteristics of each household type, and it is shown that the shape of the distribution may indeed vary markedly across them. Another of the model's refinements is the specification of a poverty line in the LES demand

system based on a unique and fixed bundle of basic-needs commodities. Because commodity prices are endogenously determined, the poverty line is as well.

Although no empirical results are presented, Decaluwé, Patry, Savard, and Thorbecke suggest that their innovations will “help shed more light on the black box pertaining to the behavior of poverty following a shock”. The authors also emphasize in the first part of their paper that Social Accounting Matrixes can be used on their own to analyze issues related to income distribution, and to a lesser extent, poverty. This involves the use of accounting multipliers in conjunction with information on the factor income of disaggregated household types.

Another approach to trade, poverty, and income distribution modeling is offered by Cogneau and Robilliard (2000). In many ways their general equilibrium model is fundamentally different from the general equilibrium models described above. Their aim is to assess the impact of different growth strategies on welfare and poverty in Madagascar. To meet this goal they embed an econometrically estimated labor allocation model based on 4,508 households *within* a general equilibrium framework. The combination of a microsimulation and general equilibrium model facilitates the modeling of a country’s overall income distribution, since it is no longer necessary to *a priori* assume an income distribution for each household type<sup>7</sup>. The combination of approaches also allows endogenous variables to be determined at the level of individual households, thereby eliminating the representative household assumption (for the most part) and its associated theoretical shortcomings.

Three aggregate sectors of the Madagascar economy are modeled: a formal sector that produces a tradable commodity, an informal sector that produces a non-tradable, and an agricultural sector that produces both a tradable and non-tradable. Productive factors include labor, agricultural capital, and formal sector capital. Agricultural and informal activity is endogenous and determined at the household level, as is agricultural labor demand. Informal labor demand is determined at the aggregate level based on demand for the informal good and agricultural labor. The supply of labor to the agricultural and

informal sectors is endogenous and determined at the individual level using the labor allocation model. Consumer demand is modeled with the Linear Expenditure System.

Macroeconomic data are from a 1995 Social Accounting Matrix constructed by Razafindrakoto and Roubaud (see the paper for more details). Microeconomic data, covering 4,508 households, are from the 1993 EPM (Enquête Permanente auprès des Ménages) survey carried out by INSTAT (the Institut National de la Statistique) on behalf of the Malagasy government.

Although endogenous variables are based on individual household behavior via the microsimulation model, results of the simulations are presented in terms of 14 representative households. Four of the representative households are urban, and differentiated according to educational attainment and gender. Eight households are rural, agricultural, and differentiated according to region and farm size. The remaining two types of households are rural, nonagricultural, and distinguished according to wealth. Although it is not clear from the paper, these typologies appear to be based on the 1993 EPM survey data set and the 1995 Social Accounting Matrix. These same data sources also provide information for the disaggregation of household income. Earnings are based on receipts from agricultural labor, informal labor, formal sector labor, capital dividends, sharecropping income, and transfers from other households or the government.

Cogneau and Robilliard consider six counterfactuals, including (i) an increase in formal sector labor demand, (ii) an increase in formal sector wages, (iii) an increase in agricultural productivity, (iv) an increase in food crop productivity, (v) an increase in cash crop productivity, and (vi) an increase in the world cash crop prices. While relative income and price changes are significant in most simulations, the effect of shocks on poverty and inequality are small. The authors identify several reasons for this finding, including the unequal distribution of productive factors across households, and the ability of households to diversify their income sources through reallocation of productive activity.

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<sup>7</sup> It is typically assumed that the income distribution within a representative household group is lognormal with endogenous mean and fixed variance.

Cogneau and Robilliard's analysis is a unique melding of microsimulation and general equilibrium modeling<sup>8</sup>. Basing the analysis on actual households facilitates the study of income distribution, since restrictive assumptions about within-group distributions and certain other aggregation issues can be avoided. Working with actual households also lends an air of realism, and allows for the possibility that there is considerable heterogeneity across households. Meanwhile, incorporation of general equilibrium mechanisms captures the redistributive effects of shocks on both sectors and households.

These accomplishments do entail higher data requirements and computational costs, however. Working with 4,508 agents requires other model dimensions to be scaled back, since, for example, the income of *each* agent needs to be tied to *each* commodity represented. As a result, the sectors and commodities of Cogneau and Robilliard's model are highly aggregated, and a number of critical macroeconomic features are ignored. Another consideration is that it is not practical to inspect the impact of a simulation on each of several thousand households. Accordingly, results must be aggregated and analyzed for a limited number of representative households, just as in conventional general equilibrium models.

## **VI. Micro-Macro Synthesis**

While the approach of Cogneau and Robilliard is innovative, there are other ways to capitalize on the detail of household survey data while availing the ability of general equilibrium models to capture the numerous links between trade and poverty. A somewhat simpler, more pragmatic means to the same end is offered by the studies in this fourth and final category of the survey, which, for lack of a better label, is entitled "micro-macro synthesis". An alternative description might be "general equilibrium simulation with post-simulation analysis". This approach is best characterized by its sequential, two-step nature. In general, a general equilibrium model is first shocked to get commodity and factor price changes. These

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<sup>8</sup> Two other studies that incorporate large numbers of actual households into a relatively standard general

are then fed into or calibrated to a post-simulation framework that calculates the effects on actual or highly disaggregated representative households. Various poverty measures can then be applied to assess the distributional effects of the shocks.

This two-step approach is similar to that employed in some partial equilibrium studies (e.g. Case 1998, Deaton 1989), except that in partial equilibrium analyses the price changes are typically for consumer goods only, and are purely hypothetical or based on real-world observations – in other words, not from a counterfactual simulation. A limitation of post-simulation analysis, at least in the view of general equilibrium practitioners, is that the reactions of households to commodity and factor price changes in the post-simulation analysis are not transmitted back to the general equilibrium model. Although this absence of feedback is not satisfactory from a theoretical point of view, the resulting error is likely to be small.

Robilliard, Bourguignon, and Robinson (2001) is one of a growing number of micro-macro studies to recently emerge. As in the Levinsohn, Berry, and Friedman paper, the authors study the effects of the 1997 Indonesian crisis on poor households. The general equilibrium model is based on a single-region Social Accounting Matrix that captures macroeconomic constraints along with intersectoral flows for 38 sectors and 15 factors of production. The post-simulation analysis is a microsimulation model based on the 1996 Susenas survey, with 33,000 individuals in 9,800 households. Conducting the analysis with actual households facilitates calculation of changes in the income distribution, since one can avoid strong assumptions about intragroup distributions and certain other aggregation issues.

Robilliard, Bourguignon, and Robinson's microsimulation model represents the way in which households generate their income, by focusing on how earnings are determined and how occupational choices are made. Workers are divided into eight groups according to skill, gender, and area of residence. Functions corresponding to wage worker earnings, farm and non-farm worker profits, and occupational

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equilibrium model are Gørtz, Harrison, Nielsen, and Rutherford (2000), and Cockburn (2001).



choices are estimated. Labor supply is modeled as a discrete choice between inactivity and full time work.

The general equilibrium model relies on standard neoclassical assumptions and is set up in “real” terms, with no asset markets, neutral money, and decisions based on relative prices. The model is dualistic in that it distinguishes between formal and informal activities in each sector, both of which produce the same good. Eight labor categories, six types of capital, and 10 household types<sup>9</sup> are distinguished, along with macro accounts for enterprises, government, the rest of the world, and for savings-investment. The real wage is assumed to be fixed in formal-sector labor markets, while informal-sector labor markets absorb any labor displaced from the formal sectors.

The general equilibrium model is linked to the microsimulation model through (i) the wage level in each wage labor market, (ii) the income level for the informal self-employed sector, (iii) the number of wage workers and self-employed by labor market segment, and (iv) consumption prices. The microsimulation model is solved so that it generates equilibrium values and changes that are consistent with the results from the general equilibrium model.

Simulations were carried out to (a) decompose and reproduce the crisis impact, (b) examine how the Indonesian economy would have fared with the same adjustment in trade balance but no credit crisis, and (c) examine different policy options, including a food price subsidy, a public work program for unskilled workers, and transfers to target groups. It is found that poverty increases over the 1997-98 period were due in *equal measure* to the El Nino drought and to the financial crisis (a very different perspective from that of the Levinsohn, Berry, and Friedman paper). The second set of experiments suggests that some of the available policy options would have resulted in a smaller increase in poverty.

On the methodological side, the Robilliard, Bourguignon, and Robinson approach is somewhat costly since the unit of analysis is an actual household, and a great deal of estimation work is required. To assess the benefits of this approach, they carried out the analysis using representative households to

compare. They determine that a representative household assumption biases most experiments, and leads to incorrect results in the case of targeted policies. In particular, the representative household approach appears to systematically *underestimate* the effect of the shocks on income inequality and poverty.

Another interesting approach to trade and poverty issues is offered by Hertel, Preckel, Cranfield, and Ivanic (2001). They examine how *global* trade liberalization affects poverty in each of seven different developing countries. While they center their analysis on factor market effects, they also allow for commodity market and terms of trade effects (altogether incorporating links (a), (b), and (e) described in section II). The first step of the authors' analysis involves conducting a policy experiment in the Global Trade Analysis Project (GTAP) model of trade (Hertel, 1997) to generate a vector of factor and commodity price changes for 17 regions of the world<sup>10</sup>. Since the GTAP database is designed for broad country coverage, it is limited to one representative household per region – clearly not adequate for an investigation of poverty. The price changes are therefore fed into a post-simulation framework that characterizes households according to factor income and consumption profiles, which are based on International Comparison Project data, and household surveys for seven countries, respectively<sup>11</sup>.

One of the authors' most striking findings is the extent to which households in each of the seven countries are specialized in terms of factor earning profiles. To capture the consequent vulnerability to trade liberalization, households are categorized into five strata, including those getting at least 95% of income from (i) transfers, (ii) agriculture, (iii) non-agricultural business, (iv) wages, and then (v) a stratum for households that have diversified income sources. Within each stratum, the differences across income levels are preserved.

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<sup>9</sup> Since factor price changes are passed on directly to the microsimulation model, disaggregation of households in the CGE model is not necessary, but is used for comparison with the microsimulation approach.

<sup>10</sup> The experiment involves complete elimination of merchandise tariff barriers as well as textile and apparel quotas in place in 1997.

<sup>11</sup> The household surveys are for Brazil, Chile, Indonesia, Philippines, Thailand, Uganda, and Zambia, and are available through the World Bank.

Changes in real household incomes are calculated, and demand response is simulated by feeding commodity price changes into an estimated global AIDADS demand system<sup>12</sup>. The demand system is used to calculate the poverty level of utility for each region. Equivalent variation (EV) and a first-order compensating variation (CV) measure are then calculated at both the per capita and poverty line levels. Since the CV approximation proves to be quite accurate compared to the exactly computed EV, it is used to decompose the results into underlying commodity and factor market adjustments. The Foster-Greer-Thorbecke measure of poverty is used to calculate the total transfer required to lift all households above the poverty level of utility, as a proportion of the poverty level of income.

Hertel, Preckel, Cranfield, and Ivanic's findings suggest that multi-lateral trade liberalization will reduce overall poverty in Indonesia, Philippines, Uganda, and Zambia, but increase overall poverty in Brazil, Chile, and Thailand. Within regions, the results vary considerably by household group. The largest poverty reduction occurs among agriculture-specialized households in Brazil, while the largest increase occurs among non-agricultural, self-employed, and wage-labor households in Brazil, Chile, and Thailand.

## **VII. Summary and Conclusions**

Quantifying the poverty impacts of trade liberalization and related external shocks is currently an area of intense research, and a variety of methodologies are being employed to address the issues involved. This survey provides a review of methods in current use, and classifies them into four broad categories, namely (i) cross-country regression analysis, (ii) partial-equilibrium/cost-of-living analysis, (iii) general-equilibrium simulation, and (iv) micro-macro synthesis (also referred to as general-equilibrium simulation with post-simulation analysis). These four groups encompass both the "bottom-up" and "top-down" traditions that are associated with poverty and trade specialists, respectively. The former approach builds on detailed survey information, and emphasizes the heterogeneity of individual

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<sup>12</sup> AIDADS is a generalization of LES, allowing for the possibility of non-linear, non-monotonic Engel effects.

households as well as commodity market linkages between trade and poverty. The latter approach begins with the representative household assumption from microeconomic theory, and generally incorporates additional linkages between trade and poverty such as factor earnings and terms of trade effects.

The general conclusion of this survey is that any analysis of trade and poverty needs to be informed by both perspectives. Indeed, the most recent and innovative studies sequentially link the top-down and bottom-up approaches in a two-step procedure, such that general equilibrium mechanisms are incorporated along with detailed household survey information. While not necessarily elegant in a theoretical sense, this approach accounts for the majority of trade-poverty linkages, is based on solid empirical foundations, and is compatible with multi-region trade modeling.

Another methodology in the same spirit and also increasingly used involves the incorporation of large numbers of actual households into a general equilibrium simulation model. This framework allows for the possibility of substantial heterogeneity across households within a region, while maintaining feedback effects between those households and the rest of the economy. Although these studies have so far been limited to a single region, there is no reason this approach cannot be adapted to multi-region modeling, such that trade-poverty comparisons can be made across countries in a consistent manner.

These developments have come through increased recognition that households are typically much more specialized in income than in consumption – making factor markets the key linkage between trade liberalization and poverty – and through the increased availability of household survey information on factor earnings.

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**Table 1. Cross-Country Regression**

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Dollar and Kraay (2001)	Trade, Growth, and Poverty	Income distribution summary statistics from UN-WIDER (2000), Deininger and Squire (1996), Ravallion and Chen (2000), Lundberg and Squire (2000). Per capita GDP from Summers and Heston Penn World Tables, and World Bank data.	Determine the statistical relationship between trade volume and inequality measures such as Gini coefficient	Trade volumes are not correlated with inequality measures, but trade is positively correlated with economic growth. Since growth reduces poverty, trade also must reduce poverty.
Dollar and Kraay (2001)	Growth is Good for the Poor	(Same as above)	Attempt to explain deviations around the one-to-one relationship between changes in average income and changes in poorest one-fifth's income using regressions that include variables such as trade volume, education, and rule of law.	There is no systematic relationship between average incomes and the share of income accruing to the poorest fifth of the income distribution. Thus, economic growth tends to reduce poverty.

**Table 2. Partial-Equilibrium/Cost-of-Living Analysis**

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Deaton (1989)	Rice Prices and Income Distribution in Thailand: A Non-parametric Analysis	Expenditure data from the 1981-2 Thailand <i>Socioeconomic Survey of the Whole Kingdom</i> serve as an indicator of income.	Combines expenditure data and hypothesized price changes to study the distributional effect of higher rice prices that would result from export liberalization in Thailand.	Higher rice prices are favorable to rural Thai households at all income levels. The principal beneficiaries are middle-income rural households.
Ravallion (1990)	Rural Welfare Effects of Food Price Changes Under Induced Wage Responses: Theory and Evidence for Bangladesh	Aggregate income statistics by source (wages, business, non-market) for 4 different income groups are from 1984 Bangladesh Bureau of Statistics <i>Statistical Yearbook of Bangladesh</i> .	Econometrically estimate welfare effects of rice price increases using time series data for Bangladesh; account for effect of higher rice prices on wage rates.	An increase in the price of rice will likely have an adverse effect on rural households for 3 to 4 years. In the long run, the rice price increase is more likely to benefit the poorest households than those who are less poor.
Ravallion and van de Walle (1991)	The Impact on Poverty of Food Pricing Reforms: A Welfare Analysis for Indonesia	Money income is estimated using household consumption expenditures in 1981 Susenas data set.	Estimate welfare distributions associated with demand response to price and income variability, using 3 stylized examples of how incomes could be affected by rice price changes.	With hypothesized full producer income effects, uncompensated trade liberalization has adverse effect on poverty. Poverty orderings depend critically on the definition and measurement of poverty.
Levinsohn, Berry, and Friedman (1999)	Impacts of the Indonesian Economic Crisis: Price Changes and the Poor	No earnings data used, except for summary statistics from Badan Pusat Statistik on how labor wages changed during the time of the Indonesian economic crisis.	Calculate change in cost-of-living by income decile using actual consumer good price changes.	Disregarding self-produced agriculture and owned housing, mean increase in cost-of-living is 130%, with the rural poor suffering most. Accounting for these effects, it is the urban poor who were most adversely affected.

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Case (2000)	Implications of Trade Policy Reform Given Income Distribution and Expenditure Patterns in South Africa	Expenditure data from the 1993 <i>South African Living Standards Survey</i> , with information on 8848 households in 360 clusters. Data set includes unspecified income and employment information that was not used in the study, except for income distributions of different ethnic groups.	Calculate compensating variation for Africans and Whites using household budget shares, LES estimates, and outside estimates of consumer good price changes due to trade reform.	Preliminary results suggest that tariff reform results in gains to both groups. A 75% tariff reduction lowers cost of reaching initial utility by roughly 2% for Africans, and by 1% for Whites.
Deaton and Tarozzi (2000)	Prices and Poverty in India	Expenditure data from 1987-88 and 1993-94 Indian <i>National Sample Survey</i> – no earnings data discussed or used in the analysis.	Calculate price indices for 1987-88 and 1993-94 across Indian states, and compare with official poverty statistics.	Results generally show agreement with official price indices with respect to rate of increase in price index over time. However, problems are found with current procedures for calculating official poverty lines.
Minot and Goletti (2000)	Rice Market Liberalization and Poverty in Viet Nam	Information on income and employment from 1992-93 <i>Viet Nam Living Standards Survey</i> of World Bank, but factor earnings not explicitly modeled.	A multimarket spatial equilibrium model is simulated for different policy scenarios; abstract away from factor market effects of higher rice prices.	Export liberalization raises rice prices within the country, giving a positive effect on rural income and a mixed but slightly favorable impact on poverty.
Dercon (2001)	The Impact of Economic Reforms on Households in Rural Ethiopia, 1989-1995	1989 and 1994-95 panel data set on 362 rural households in 6 communities (not necessarily representative of Ethiopia). Household income disaggregated into earnings from land, wages, livestock, business income, and transfers.	Changes in welfare of households between the two time periods of the survey are explained by regression on household characteristics.	In general growth is pro-poor, but results are mixed. One group with good land, labor, and location improved substantively over the period; another less well-endowed group experienced little change.
McCulloch and Calandrino (2001)	Poverty Dynamics in Rural Sichuan between 1991 and 1995	1991-1995 panel data set of 3311 households in rural Sichuan collected by the Chinese National Bureau of Statistics. Household income disaggregated into earnings from wages, business profits, transfers, and assets income.	Provides measures of poverty across 5 years based on household surveys. Measures vulnerability to moving into and out of poverty.	Households are highly vulnerable to falling into poverty even when their average consumption is over 20% above the poverty line.
Appleton (2001)	Poverty Reduction During Growth: the Case of Uganda, 1992-2000	Data set consists of 6 nationally representative surveys from Uganda from 1992-2000. Earnings information not discussed or used.	Household surveys are used to estimate changes in average living standards, poverty and inequality during 1992-2000, in which there was rapid economic growth.	The results suggest that poverty fell for all decile groups and socio-economic categories, regardless of the poverty line used.
Fofack, Monga, and Tuluy (2001)	Household Welfare and Poverty Dynamics in Burkina Faso: Empirical Evidence from Household Surveys	Use 1994 and 1998 household surveys, ( <i>Enquête Prioritaire I and II</i> ) which appear to include limited information on employment and income of survey participants.	Calculate Foster-Greer-Thorbecke poverty measure and Gini inequality measure using household expenditure data for 1994 and 1998.	Economic growth resulting Burkina Faso's exchange rate devaluation was undermined by increasing inequality. Suggested causes are disparities in human capital, wages, and access to productive factors.

**Table 3. General-Equilibrium Simulation<sup>13</sup>**

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Adelman and Robinson (1978)	Income Distribution Policy: A CGE Model of South Korea	15 household types based on 15 occupational groups, including skilled and unskilled workers in different industries, agricultural workers, government workers, capitalists. Disaggregation based on reconciling information from the Korean <i>Special Integrated Household Expenditure Employment Survey</i> , <i>Urban household survey</i> , <i>Farm household survey</i> , and others.	First general equilibrium model to be applied to a developing country. While neoclassical, it contains a number of non-neoclassical features. Models the functional income distribution assuming a simple lognormal income distribution for each household type.	Most policies tend to have little effect on size distribution of income (as given by an estimated 2-parameter lognormal distribution). However, when ownership of human capital and land is equitable, a labor and skill-intensive export-oriented strategy can improve the distribution of income.
Lysy and Taylor (1980)	The General Equilibrium Income Distribution Model	12 different types of income recipients spread across 25 sectors, for a total of 130 classes in total. Income arises from one of 3 possible sources: labor, capital, or a proprietorship. Based largely on a 1959 I-O matrix by Willy van Rijckeghem (1969) and on Brazilian income distribution data from Albert Fishlow (1972, 1973).	In the structuralist tradition. Society is made up of conflicting groups that differ by employment. Model includes a forced saving mechanism and limits the amount of output adjustment.	Reaches opposite conclusion of Adelman and Robinson – public policy contributed to the deterioration in the distribution of income over the period studied. A later study by Adelman and Robinson (1988) attempts to reconcile the different findings, and suggests they are due to differing definitions of the income distribution.
Bourguignon, Branson, and de Melo (1989)	Adjustment and Income Distribution: A Counterfactual Analysis	None (archetype economy).	Links the micro elements (relative price shifts) by which structural adjustment policies affect income distribution with the macro elements (asset prices) of adjustment packages that affect income distribution through level of economic activity.	Stabilization packages which do not have specific components targeted towards the poor will have a noticeable adverse effect on the distribution of income, which is likely to result in some form of permanent damage for those below the poverty line.
Sadoulet and de Janvry (1992)	Agricultural Trade Liberalization and Low Income Countries: A GE-Multimarket Approach	None (archetype economy).	Construct integrated multimarket general equilibrium model for 3 archetypical groups of developing countries, distinguished on the basis of whether domestic food crop production is competitive with imported cereals. Incorporates 2 types of labor and 5 types of households.	The expected 20% increase in world cereal prices following OECD trade liberalization results in rising food import bills and exchange rate depreciation in African countries with noncompetitive cereal imports; the opposite happens in other African and Asian countries.
Coxhead and Warr (1995)	Does Technical Progress in Agriculture Alleviate Poverty? A Philippine Case Study	7 household types, distinguished based on ownership of mobile labor and capital, and 4 sector-specific factors. Based on a 1985 Philippines National Statistics Office <i>Family Income and Expenditure Survey</i> .	General equilibrium model of Philippines with 3 commodities and 4 sectors is used to measure and decompose the effects of technical change on poverty. General equilibrium closures are compared to partial equilibrium closures.	Factor market adjustments are substantially more important than spending effects when technological progress occurs. When poverty sensitive welfare weights are used, partial equilibrium analysis predicts smaller welfare gain than general equilibrium analysis.

<sup>13</sup> With regard to the column on earnings data (column 3), the general equilibrium analyses generally employed multiple stylized households unless otherwise indicated. Additionally, the method used to link a representative household's income to productive factors was almost never described in the studies. It is generally implied that factor earnings links are based on an underlying Social Accounting Matrix.

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Bautista and Thomas (1997)	Income Effects of Alternative Trade Policy Adjustments on Philippine Rural Households: A GE Analysis	3 rural (large-farm, small-farm & other) and 2 urban (metro Manila & other) household types. Based on a 1979 Philippines Social Accounting Matrix with 4 primary factors (unskilled labor, skilled labor, land, capital).	General equilibrium model is based on 3 types of trade policy adjustments dealing with an unsustainable current account deficit are simulated.	Tariff liberalization is superior to policy options that are more restrictive to trade, since there are larger benefits to small-farm and other rural households relative to the more affluent Metro Manila, other urban, and large-farm households.
Löfgren (1999)	Trade Reform and the Poor in Morocco: A Rural-Urban GE Analysis of Reduced Protection	4 household types, distinguished according to whether they poor/non-poor, and rural/urban orientation. Based on a 1994 Social Accounting Matrix, for which the population, consumption, and labor force information is derived from various <i>Royaume du Maroc</i> statistical volumes, as well as World Bank and IMF statistics.	A special feature of the Social Accounting Matrix is the attempt to capture pronounced rural-urban distinctions in skills, wages, and sectors that are prevalent in Morocco.	Trade liberalization in agriculture will result in gains for the country as a whole, while the rural poor loses out. Compensation for rural areas is likely needed for liberalization to be pursued.
Decaluwé, Patry, Savard, and Thorbecke (1999)	Poverty Analysis within a General Equilibrium Framework	None (archetype economy).	First part focuses on how Social Accounting Matrixes can be used to analyze income distribution. In second part, a general equilibrium framework is developed in which the poverty line is endogenous, and a flexible Beta functional form is used to model intragroup income distribution.	The analysis is for an archetype economy, so no numerical results are available. The highlights are the relatively general functional form for the within-group income distribution, and methodology for incorporating an endogenous poverty line.
Cogneau and Robilliard (2000)	Growth, Distribution and Poverty in Madagascar: Learning from a Microsimulation Model in a General Equilibrium Framework	Earnings data are split out across 6 income sources for 4,508 households are from the 1993 EPM survey carried out by INSTAT on behalf of the Malagasy government. This is linked to macroeconomic data from a 1995 Madagascar Social Accounting Matrix constructed by Razafindrakoto and Roubaud.	This is a novel approach, since endogenous variables are determined by 4,508 actual households, and incorporated into an overall general equilibrium framework. Results are presented in terms of 14 household types. A key benefit is that within-group income distribution variance is endogenized. However, only 3 sectors are modeled, and there is limited macroeconomic structure.	While relative income and price changes are generally significant, the impact of the various shocks on the aggregate indicators of poverty and inequality tend to be small.
Harrison, Rutherford, and Tarr (2000)	Trade Liberalization, Poverty and Efficient Equity	19 rural households and 21 urban households, distinguished by income level. 8 types of labor and 2 types of capital. Based on a 1990 Social Accounting Matrix constructed by De Santis and Ozhan. The authors note that 'it does not appear that production labor is mapped into the sectors that use it using defensible economic criteria'.	Addresses the possibility of combining policies so that no poor household is harmed from trade policy reform.	Trade liberalization leads to some groups of the rural and urban poor being worse off in the absence of compensation. Direct compensation mechanisms appear to work well in the case of trade reform in Turkey, even when accounting for costs of raising revenue.
Gørtz, Harrison, Nielsen, and Rutherford (2000)	Welfare Gains of Extended Opening Hours in Denmark	None, although use is made of a survey quantifying how 613 Danish households allocate their time.	Has nothing to do with trade and poverty, but illustrates how 613 households can be directly incorporated in a general equilibrium model.	There are substantial consumer welfare gains from liberalizing the regulations on shopping hours in Denmark. Poorer households tend to benefit more than wealthier households.

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Devarajan and Mensbrugghe (2000)	Trade Reform in South Africa: Impacts on Households	24 households comprised of 6 income categories and 4 ethnic groups. Within each ethnic group, labor is further divided into 13 categories, making for 52 types of workers. Based on a 1992 South African Social Accounting Matrix.	Four model specifications concerning the revenue replacement issue that arises with complete removal of tariffs.	Removal of tariffs will likely reduce the average welfare of white households but improve the average welfare of black households. Within ethnic groups, richer black and poorer white households are likely to benefit.
Levin (2000)	Kenya – Poverty Eradication Through Transfers	6 rural households are distinguished by size and type of landholding. 4 urban households are distinguished by education level. Based on a 1986 Social Accounting Matrix of Kenyan Ministry of Planning and National Development, which was constructed using Kenya's <i>Urban Household Budget Survey</i> , <i>Rural Household Budget Survey</i> and <i>Labour Market Survey</i> .	Use general equilibrium model with 9 sectors to calculate transfers needed to yield zero headcounts in the Foster-Greer-Thorbecke poverty index.	A transfer to a specific group can alleviate poverty in that group, but depending on how this is financed it may affect non-targeted groups negatively.
Lee Harris (2001)	A Computable General Equilibrium Analysis of Mexico's Agricultural Policy Reforms	15 households are differentiated according to region and income level. 4 types of non-ag labor (professional, white-collar, blue-collar, and unskilled) and 4 types of ag. labor categories. Based on a 1996 Mexican Social Accounting Matrix – household income and expenditure data come from the 1994 <i>Encuesta Nacional de Ingresos y Gastos de Hogares</i> , INEGI.	In contrast to most other studies in this section, this general equilibrium model distinguishes 4 regions within the economy.	A system of lump sum payments to farmers is preferable to the old system of subsidies and price supports. However, in the event of an exchange rate devaluation, the old system performs better in terms of rural incomes and output.
Löfgren, Chulu, Cichinga, Simtowe, Tchale, Tseka, Wobst (2001)	External Shocks and Domestic Poverty Alleviation: Simulations with a CGE Model of Malawi	8 households distinguished by land holdings (some have no ag. income), education, urban/rural orientation. Income is from ag. labor, land, non-ag. labor, ag. capital, and/or govt. transfers. Based on 1998 Malawi Social Accounting Matrix from Chulu and Wobst (2000), which is based partly on the 1997-98 <i>Malawian Integrated Household Survey</i> published by the Malawi National Statistical Office.	Simulations designed assess impact of tax-based land reform and its sensitivity to various assumptions.	Real depreciation has a pro-rural bias and is effective at eliminating balance-of-payment difficulties. An expanded public works program generates significant gains for the rural poor, but negatively affects non-agricultural households.
Evans (2001)	Identifying Winners and Losers in Southern Africa from Global Trade Policy Reform	Global Trade Analysis Project (GTAP) database distinguishes 1 household in Zambia, that receives income from 5 factors. Results are also presented in terms of 4 stylized households distinguished by location and income.	Examine the effect of trade liberalization on poverty in Zambia using both a case study approach and the GTAP general equilibrium model. The study's hypothesis is that these two approaches are highly complementary. Five alternative policy scenarios are considered.	Regionally based trade policy reforms generally have a neutral or adverse impact on poverty. Favorable distribution impacts on poverty from trade policy reform are anticipated in a global WTO liberalization scenario, and in a EU/SADC7 scenario.

Authors	Title of study	Time and source of earnings data	Notes on approach	Principal findings
Cockburn (2001)	Trade Liberalization and Poverty in Nepal: A Computable General Equilibrium Micro-Simulation Approach	1995 Nepalese Living Standards Survey (NLSS) gives income sources for 3,373 households, although income data not clearly distinguished between labor (skilled and unskilled) and capital (land, ag. capital and non-ag. capital) as used in the 1986 Social Accounting Matrix. Income shares of these factors from the Social Accounting Matrix were applied to the NLSS data in order to separate out these sources.	Similar in spirit to the framework of Cogneau and Robilliard, a general equilibrium model is constructed that explicitly models 3,373 households. This enables determination of how trade liberalization impacts <i>individual</i> households and how these results feed back into the general equilibrium of the economy.	Results suggest that impact of trade liberalization is complex and varies substantially by household, but that effect on overall income distribution is small. The absolute impact of liberalization – whether positive or negative – generally increases with the level of income.
Warr (2001)	Welfare and Distributional Effects of an Export Tax: Thailand's Rice Premium	10 household types distinguished by income quintile, and rural versus urban orientation. Earnings are based on holdings of skilled and unskilled labor (distinguished by education), land, agric. capital, and non-agric. capital (mobile and fixed). Based on a 1988 Thai NSO <i>Socio-economic survey</i> .	Examine the distributional impacts of a rice export tax for Thailand, which has a small degree of market power in world market. A method is demonstrated whereby the optimal tax can be determined.	The negative effect of lower unskilled wages outweighs the benefit of lower rice prices, causing both the rural and urban poor to be harmed by an export tax.



**Table 4. Micro-Macro Synthesis**

Authors	Title of study	Type and source of earnings data	Notes on approach	Principal findings
Friedman (2000)	Differential Impacts of Trade Liberalization on Indonesia's Poor and Non-poor	Income sources for each of 62,010 households in 1996 <i>Susenas</i> survey include wages, ag. and non-ag business income, house rent, pensions, dividends, transfers, and asset sales. Global Trade Analysis Project (GTAP) database gives income for a representative Indonesian household based on 5 factors. Paper describes assumptions made to reconcile GTAP factor income with <i>Susenas</i> income sources.	Simulate GTAP model under Indonesian unilateral trade liberalization, and then global trade liberalization. Calculate household-specific compensating variation associated with commodity price changes. Adjust this for income changes (as given by GTAP model's factor price changes) to get net effect per household.	Under both trade liberalization scenarios, few or no households are made worse off, but distribution of gains from liberalization tends to be skewed towards the urban rather than the rural, and the wealthy rather than the poor.
Iancho-vichina, Nicita, and Soloaga (2001)	Trade Reform and Household Welfare: The Case of Mexico	Information on 47 income sources for each of 14,042 households provided by 1996 Mexican <i>National Household Income and Expenditure Survey</i> . These 47 income sources are mapped to 5 Global Trade Analysis Project (GTAP) factors using a number of arbitrary assumptions.	Use price changes from GTAP model simulated under the NAFTA agreement in conjunction with household survey information for Mexico to compute changes in income distribution and poverty. Avoids representative household assumption	Tariff reform will have a positive effect on welfare for all income deciles. An assumption of homothetic preferences results in larger welfare gains, while a non-homothetic assumption results in the poor gaining the most.
Robilliard, Bourguignon and Robinson (2001)	Crisis and Income Distribution: A Micro-Macro Model for Indonesia	Information on earnings (various wage work and self-employment) for sub-sample of 9,800 households provided by 1996 <i>Susenas</i> survey. General equilibrium model is based on 1995 Social Accounting Matrix that has 8 labor categories, 6 types of capital, and land. Mapping between factors in general equilibrium model and the household data is not described.	Simulate Indonesian financial crisis with general equilibrium model to get aggregate price changes, and then solve an estimated microsimulation model of household income such that it generates aggregate changes consistent with the general equilibrium model – avoids representative household assumption.	Poverty increases over the 1997-98 period were due in equal measure to the El Nino drought and to the financial crisis. Use of some available policy options would have resulted in a smaller increase in poverty.
Hertel, Preckel, Cranfield, and Ivanic (2001)	Poverty Impacts of Multilateral Trade Liberalization	Use household surveys with earnings information for Brazil, Chile, Indonesia, Philippines, Thailand, Uganda, and Zambia (available from World Bank). Across the surveys, categorize households into 5 strata, including those getting at least 95% of income from (i) transfers, (ii) agriculture, (iii) non-ag. business, (iv) wages, and then (v) a stratum for households that have diversified income sources.	Simulate global trade liberalization with Global Trade Analysis Project (GTAP) general equilibrium model to get factor and commodity price changes by region. These are then used in conjunction with estimated expenditure functions and factor earnings information across 5 strata (and income levels within a strata) to assess the welfare of marginal households in each of 7 countries.	Trade liberalization generally results in reduced poverty in each of the 7 focus countries. Indonesia experiences the largest national reduction in poverty. The experience of particular groups within the countries is mixed.



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